INLET ISSUES

Inlets are a fundamentally important part of our coastal system by virtue of their roles in both human activities and barrier island maintenance and evolution. But inlets are not fixed in space and time and this fact is at the root of several inlet-related coastal management issues. This White Paper is produced for coastal managers, agencies, business owners, coastal residents, etc., to provide a general overview of the workings of inlet systems as we struggle to live with their dynamic nature during a time of sea-level rise and high storm activity.

INLET PROCESSES

Inlets provide for the interchange of fresh and marine waters within the estuarine system. The number and size of inlets is naturally adjusted to (i.e., is in equilibrium with) the volume of water discharged from the rivers and the amount of water that enters and exits the estuaries daily due to astronomical and wind tides (the "tidal prism"). Typically, where tidal energy is high, such as in southern NC, many inlets are required to accommodate the exchange of seawater during a tidal cycle, resulting in more inlets and shorter islands. Where the tidal range is minimal, inlets act primarily as outlets for fresh water that flows into the estuaries from the rivers. This situation results in fewer inlets and longer barrier islands. Currently, within the Albemarle-Pamlico Estuarine System (APES) the river discharge is relatively low and the average length of time that water stays in the sounds (residence time) is approximately 11 months. Except in the vicinity of inlets, astronomical tides within the APES are small (<1 ft.). However wind tides associated with a variety of weather systems increase the volume of water being exchanged between the estuaries and ocean. Storm events frequently result in the formation of ephemeral inlets to accommodate this additional exchange. Due to the low volume of freshwater discharge and small astronomical tidal prism, few inlets occur along the Outer Banks north of Cape Lookout, and currently include New Drum, New Old Drum, and Ophelia inlets in Core Banks, Ocracoke Inlet, Hatteras Inlet, and Oregon Inlet (Fig. 1).

Figure 1. MODIS satellite image showing the location of active inlets between the Virginia state line and Cape Lookout, NC. Satellite image courtesy of Institute for Marine Remote Sensing, College of Marine Science, University of South Florida.

An inlet consists of a variety of geomorphic components (Fig. 2). The inlet channel that separates the adjacent islands is the throat channel and consists of a central main ebb channel and flanking marginal flood channels. The cross-sectional area of the throat channel conforms to the volume of water that must pass through it. When the water volume is decreased, the channel will tend to shoal. If the volume increases, the channel will deepen and/or widen.

Depending on wave and current patterns, sand transport between islands may take a circuitous route to bypass the intervening inlet. Sand is moved along the beach and nearshore area parallel to the coastline in response to waves as they encounter the shallow coastal environments. Along the Outer Banks, sand generally moves from north to south in the longshore current owing to the cumulative high energy wave action from the northeast. As sand encounters the